

Case: FR-7291
Application No.: 10/719,948

Amendments to the Claims:

1. (Currently Amended) A flame retardant which comprises the reaction product of
(A) at least one brominated aromatic diester diol with
(B) at least one alcohol-reactive agent which is (i) an anhydride containing from four to about eight carbon atoms, (ii) ~~an acyl halide containing from two to about eight carbon atoms,~~ (iii) at least one dihydrocarbyl phosphate, (iii) (iv) at least one dihalohydrocarbyl phosphate, wherein each halogen atom is chlorine or bromine, (iv) (v) at least one dihydrocarbyl chlorophosphate, (v) (vi) at least one dihalohydrocarbyl chlorophosphate, wherein each halogen atom is chlorine or bromine, (vi) (vii) at least one dihydrocarbyl chlorothiophosphate, (vii) (viii) at least one dihalohydrocarbyl chlorothiophosphate, wherein each halogen atom is chlorine or bromine, or (viii) (ix) mixtures of two or more of the foregoing.
2. (Original) A flame retardant according to Claim 1 wherein (A) consists essentially of a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol.
3. (Original) A flame retardant according to Claim 1 wherein (B) is an anhydride or a dihydrocarbyl chlorophosphate.
4. (Original) A flame retardant according to Claim 1 wherein (B) is acetic anhydride.
5. (Original) A flame retardant according to Claim 1 wherein (B) is a diaryl chlorophosphate.
6. (Original) A flame retardant according to Claim 5 wherein said diaryl chlorophosphate is diphenyl chlorophosphate.
7. (Original) A flame retardant according to Claim 1 wherein (A) consists essentially of a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol, and wherein (B) is an anhydride or a dihydrocarbyl chlorophosphate.
8. (Original) A flame retardant according to Claim 1 wherein (A) consists essentially of a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol, and wherein (B) is acetic anhydride.

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9. (Original) A flame retardant according to Claim 1 wherein (A) consists essentially of a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol, and wherein (B) is a diaryl chlorophosphate.

10. (Original) A flame retardant according to Claim 1 wherein (A) consists essentially of a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol, and wherein (B) is diphenyl chlorophosphate.

11. (Currently Amended) A process for preparing a flame retardant which comprises reacting contacting (A) at least one brominated aromatic diester diol and (B) at least one alcohol-reactive agent which is (i) an anhydride containing from four to about eight carbon atoms, (ii) an acyl halide containing from two to about eight carbon atoms, ~~(iii)~~ at least one dihydrocarbyl phosphate, ~~(iii)~~ (iv) at least one dihalohydrocarbyl phosphate, wherein each halogen atom is chlorine or bromine, ~~(iv)~~ (v) at least one dihydrocarbyl chlorophosphate, ~~(v)~~ (vi) at least one dihalohydrocarbyl chlorophosphate, wherein each halogen atom is chlorine or bromine, ~~(vi)~~ (vii) at least one dihydrocarbyl chlorothiophosphate, ~~(vii)~~ (viii) at least one dihalohydrocarbyl chlorothiophosphate, wherein each halogen atom is chlorine or bromine, or ~~(viii)~~ (ix) mixtures of two or more of the foregoing to form a reaction product.

12. (Original) A process according to Claim 11 wherein (A) consists essentially of a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol.

13. (Original) A process according to Claim 11 wherein (B) is an anhydride or a dihydrocarbyl chlorophosphate.

14. (Original) A process according to Claim 11 wherein (B) is acetic anhydride.

15. (Original) A process according to Claim 11 wherein (B) is a diaryl chlorophosphate.

16. (Original) A process according to Claim 15 wherein said diaryl chlorophosphate is diphenyl chlorophosphate.

17. (Original) A process according to Claim 11 wherein (A) consists essentially of a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol, and wherein (B) is an anhydride or a dihydrocarbyl chlorophosphate.

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18. (Original) A process according to Claim 11 wherein (A) consists essentially of a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol, and wherein (B) is acetic anhydride.

19. (Original) A process according to Claim 11 wherein (A) consists essentially of a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol, and wherein (B) is a diaryl chlorophosphate.

20. (Original) A process according to Claim 11 wherein (A) consists essentially of a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol, and wherein (B) is diphenyl chlorophosphate.

21. (Original) A process according to Claim 11 wherein a reaction product mixture is formed by contact of (A) and (B), and wherein said reaction product mixture is treated with an epoxide.

22. (Original) A process according to Claim 21 wherein said reaction product mixture is subjected to vacuum distillation prior to being treated with said epoxide.

23. (Original) A process according to Claim 21 wherein said the hydrocarbyl portion of said epoxide is a branched or straight chain.

24. (Original) A process according to Claim 23 wherein said epoxide is ethylene oxide, propylene oxide, or isobutylene oxide.

25. (Original) A process according to Claim 18 wherein a reaction product mixture is formed by contact of (A) and (B), and wherein said reaction product mixture is treated with an epoxide.

26. (Original) A process according to Claim 21 wherein said reaction product mixture is subjected to vacuum distillation prior to being treated with said epoxide.

27. (Original) A process according to Claim 25 wherein said epoxide is ethylene oxide, propylene oxide, or isobutylene oxide.

28. (Original) A liquid flame retardant additive composition which comprises a liquid mixture formed from at least the following components or ingredients:

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- a) at least one reaction product of a brominated aromatic diester diol and an alcohol-reactive agent, wherein said alcohol-reactive agent is (i) an anhydride containing from four to about eight carbon atoms, (ii) an acyl halide containing from two to about eight carbon atoms, (iii) at least one dihydrocarbyl phosphate, (iv) at least one dihalohydrocarbyl phosphate, wherein each halogen atom is chlorine or bromine, (v) at least one dihydrocarbyl chlorophosphate, (vi) at least one dihalohydrocarbyl chlorophosphate, wherein each halogen atom is chlorine or bromine; (vii) at least one dihydrocarbyl chlorothiophosphate; (viii) at least one dihalohydrocarbyl chlorothiophosphate, wherein each halogen atom is chlorine or bromine; or (ix) mixtures of two or more of the foregoing;
- b) at least one hindered amine antioxidant; and
- c) at least one phenolic antioxidant in which the phenolic ring is substituted by an alkanoic acid alkyl ester group in which alkanoic acid moiety has in the range of 2 to about 4 carbon atoms and the alkyl group has in the range of about 6 to about 16 carbon atoms; wherein the amounts of components or ingredients a), b), and c) used in forming said mixture are such that on a weight basis (1) the proportions of a) to b) are in the range of about 30:70 to about 70:30; (2) the proportions of b) to c) are in the range of about 3:1 to about 1:3; and (3) the weight ratio of a) to b) plus c) is in the range of about 5:1 to about 25:1.

29. (Original) A composition as in Claim 28 wherein a) consists essentially of a reaction product of an anhydride and a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol, or consists essentially of a reaction product of a dihydrocarbyl chlorophosphate and a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol.

30. (Original) A composition as in Claim 28 wherein a) consists essentially of a reaction product of acetic anhydride and a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol.

31. (Original) A composition as in Claim 28 wherein a) consists essentially of a reaction product of a diaryl chlorophosphate and a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol.

32. (Original) A composition as in Claim 28 wherein a) consists essentially of a reaction product of diphenyl chlorophosphate and a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol.

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33. (Original) A composition as in Claim 28 wherein b) consists essentially of at least one liquid alkylated diphenylamine in which the alkyl ring substituent or substituents each contain in the range of about 4-9 carbon atoms.

34. (Original) A composition as in Claim 28 wherein c) consists essentially of a C₇-C₉ branched alkyl ester of 3,5-di-tert-butyl-4-hydroxyphenylpropionic acid.

35. (Original) A composition as in Claim 28 wherein a) consists essentially of a reaction product of an anhydride and a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol, or consists essentially of a reaction product of a dihydrocarbyl chlorophosphate and a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol; wherein b) consists essentially of at least one liquid alkylated diphenylamine in which the alkyl ring substituent or substituents each contain in the range of about 4-9 carbon atoms; and wherein c) consists essentially of a C₇-C₉ branched alkyl ester of 3,5-di-tert-butyl-4-hydroxyphenylpropionic acid.

36. (Original) A composition as in Claim 28 wherein a) consists essentially of a reaction product of acetic anhydride and a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol; wherein b) consists essentially of at least one liquid alkylated diphenylamine in which the alkyl ring substituent or substituents each contain in the range of about 4-9 carbon atoms; and wherein c) consists essentially of a C₇-C₉ branched alkyl ester of 3,5-di-tert-butyl-4-hydroxyphenylpropionic acid.

37. (Original) A composition as in Claim 28 wherein a) consists essentially of a reaction product of a diaryl chlorophosphate and a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol; wherein b) consists essentially of at least one liquid alkylated diphenylamine in which the alkyl ring substituent or substituents each contain in the range of about 4-9 carbon atoms; and wherein c) consists essentially of a C₇-C₉ branched alkyl ester of 3,5-di-tert-butyl-4-hydroxyphenylpropionic acid.

38. (Original) A composition as in Claim 28 wherein a) consists essentially of a reaction product of diphenyl chlorophosphate and a mixed ester of tetrabromophthalic anhydride with diethylene glycol and propylene glycol; wherein b) consists essentially of at least one liquid alkylated diphenylamine in which the alkyl ring substituent or substituents each contain in the range of about 4-9 carbon atoms; and wherein c) consists essentially of a C₇-C₉ branched alkyl ester of 3,5-di-tert-butyl-4-hydroxyphenylpropionic acid.

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39. (Original) A method of producing a flexible polyurethane foam composition of the type formed from isocyanate and polyol, which method comprises (I) including in a polymerization formulation:

- a) at least one reaction product of a brominated aromatic diester diol and an alcohol-reactive agent, wherein said alcohol-reactive agent is (i) an anhydride containing from four to about eight carbon atoms, (ii) an acyl halide containing from two to about eight carbon atoms, (iii) at least one dihydrocarbyl phosphate, (iv) at least one dihalohydrocarbyl phosphate, wherein each halogen atom is chlorine or bromine, (v) at least one dihydrocarbyl chlorophosphate, (vi) at least one dihalohydrocarbyl chlorophosphate, wherein each halogen atom is chlorine or bromine; (vii) at least one dihydrocarbyl chlorothiophosphate; (viii) at least one dihalohydrocarbyl chlorothiophosphate, wherein each halogen atom is chlorine or bromine; or (ix) mixtures of two or more of the foregoing;
- b) at least one hindered amine antioxidant; and
- c) at least one phenolic antioxidant in which the phenolic ring is substituted by an alkanoic acid alkyl ester group in which alkanoic acid moiety has in the range of 2 to about 4 carbon atoms and the alkyl group has in the range of about 6 to about 16 carbon atoms;

in amounts sufficient to provide flame retardancy and scorch resistance to the flexible foam being produced, and

(II) reacting the resultant formulation to form a flame retardant scorch resistant flexible polyurethane foam.

40. (Original) A flame retardant flexible polyurethane foam formed from components or ingredients comprising isocyanate, polyol, surfactant, catalyst, and blowing agent, wherein the components or ingredients used in forming said polyurethane foam are further comprised of:

- a) at least one reaction product of a brominated aromatic diester diol and an alcohol-reactive agent, wherein said alcohol-reactive agent is (i) an anhydride containing from four to about eight carbon atoms, (ii) an acyl halide containing from two to about eight carbon atoms, (iii) at least one dihydrocarbyl phosphate, (iv) at least one dihalohydrocarbyl phosphate, wherein each halogen atom is chlorine or bromine, (v) at least one dihydrocarbyl chlorophosphate, (vi) at least one dihalohydrocarbyl chlorophosphate, wherein each halogen atom is chlorine or

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- bromine; (vii) at least one dihydrocarbyl chlorothiophosphate; (viii) at least one dihalohydrocarbyl chlorothiophosphate, wherein each halogen atom is chlorine or bromine; or (ix) mixtures of two or more of the foregoing;
- b) at least one hindered amine antioxidant; and
 - c) at least one phenolic antioxidant in which the phenolic ring is substituted by an alkanoic acid alkyl ester group in which alkanoic acid moiety has in the range of 2 to about 4 carbon atoms and the alkyl group has in the range of about 6 to about 16 carbon atoms;
- in amounts sufficient to provide flame retardancy and scorch resistance to the flexible foam.